

Modeling the Greenhouse Effect

Name: _____

Date: _____

Score: _____

Background

The surface of the Earth, warmed by solar radiation, has an average temperature around +18 degrees C (59 F). This terrestrial radiation is in the infrared band of the electromagnetic spectrum. Infrared radiation is the heat you feel when you hold your hand near a warm radiator. Your hand, like everything else in the universe, radiates heat. Heat and light are both forms of energy, but unlike visible light, infrared radiation can be absorbed by certain gases in the atmosphere.

The infrared energy that is absorbed in the atmosphere makes the air warm. The air in turn, radiates heat which is still at infrared wavelengths. Some of this that goes back toward the surface, warming the land, the water, and organisms. This atmosphere-surface cycling of heat energy is known as the greenhouse effect and the gases involved in this process are called greenhouse gases.

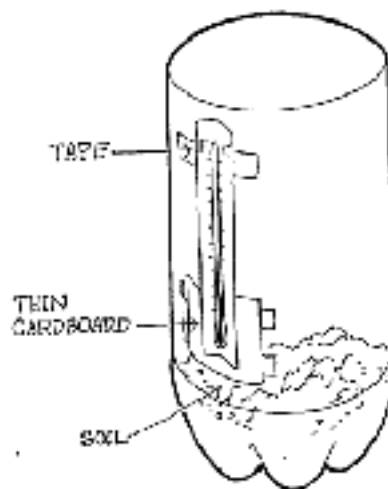
The greenhouse effect is a natural, integral part of the Earth system. Without it, we would not be here. Our planet is comfortably warm for life because it is surrounded by a “blanket” of air that keeps the Earth some 33 degrees C warmer than it would be otherwise, and allows for the existence of oceans of liquid water and organisms like ourselves.

Objective: To form a model of the heating of the Earth’s atmosphere which will demonstrate an important function of the atmosphere.

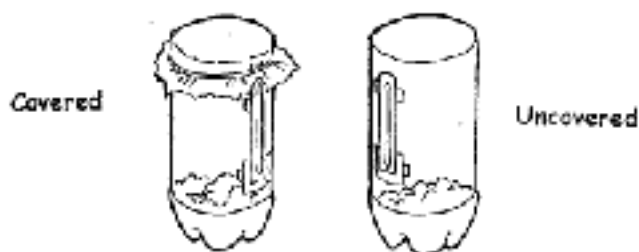
Materials: Two cut-off plastic bottles, 2 thermometers, masking tape, soil, plastic wrap, graph paper.

Procedure

1. Have students tape a thin piece of masking tape over the bulb of each thermometer to protect it from direct heat.
2. Students will add 2 cm of soil to each bottle.
3. The thermometer should be taped to the side of each bottle about 4 cm from the top and above the level of the soil. (See Image 1)



4. Students should record the temperature of the thermometer on the data table.
5. Students will place plastic wrap over the top of one of the bottles and tape it shut. The other bottle will remain uncovered.



6. Both bottles should be placed in sunlight or under a sun lamp.
7. Students will measure & record the temperature in each bottle every minute for 15 minutes in the data table.
8. At the end of 15 minutes, students will complete the Conclusion section.

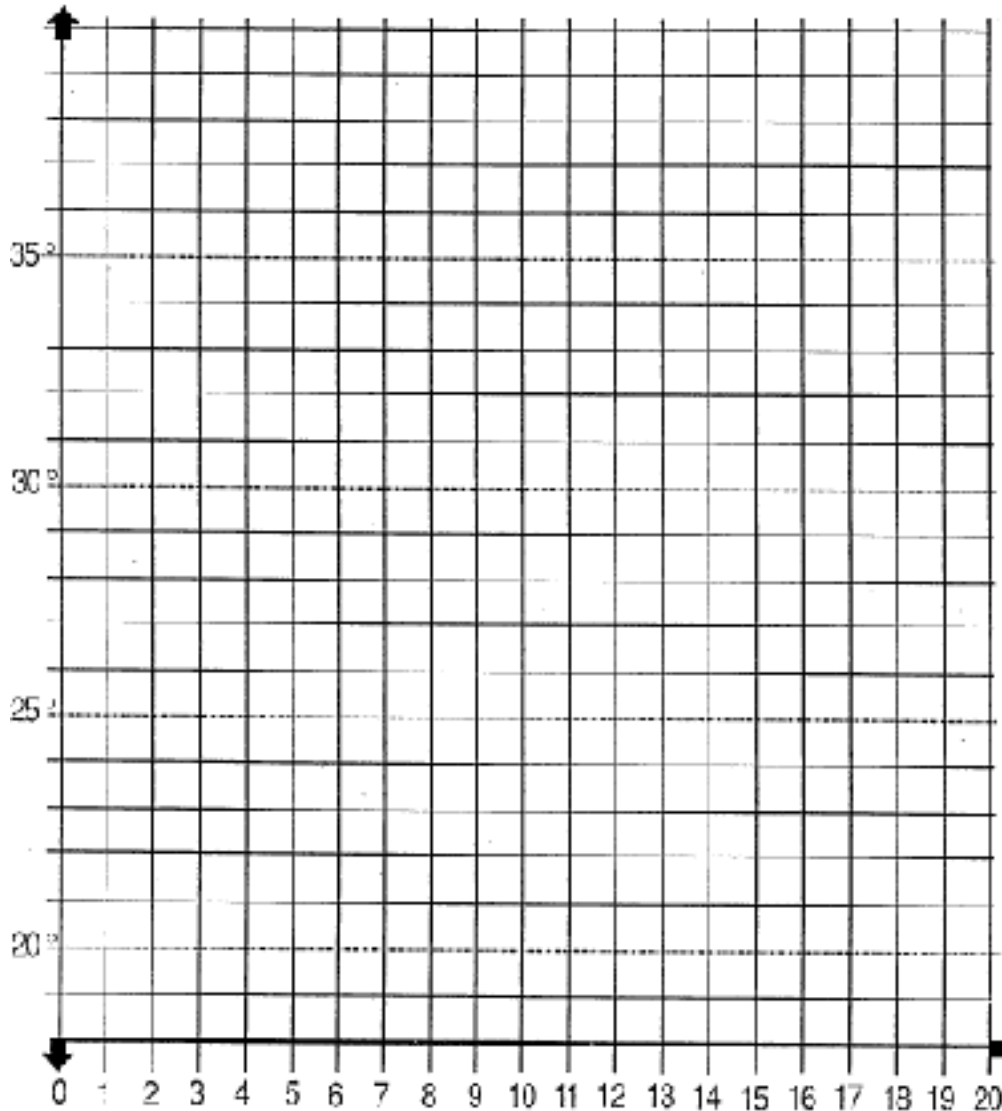
Collecting Data

Time	Covered Bottle	Uncovered Bottle	Time	Covered Bottle	Uncovered Bottle
1			10		
2			11		
3			12		
4			13		
5			14		
6			15		
7					
8					
9					

Analyzing Data

Set up a graph illustrating the measurements in the data table. Label the Y-axis Temperature (C), label X - axis Time (Minutes). Use different colors for each bottle.

Modeling the Greenhouse Effect



Conclusions

1. Which bottle heated up more rapidly?
2. If glass, aluminum foil, or waxed paper were used instead of plastic wrap, what would be the results? Give reasons for your answer.
3. Which bottle is more like a model of Earth's atmosphere? How do you know?
4. In what way is the Earth's greenhouse effect different from the bottle?